

# EXERCISES

For more practice, see *Extra Practice*.

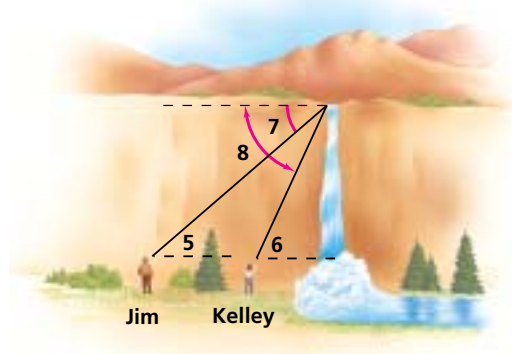
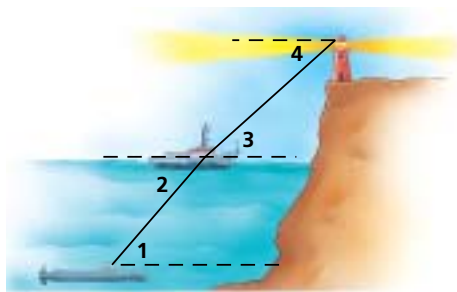
## Practice and Problem Solving

### A Practice by Example

**Example 1**  
(page 482)

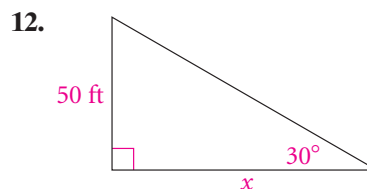
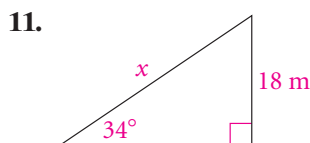
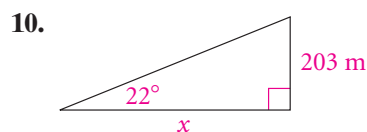
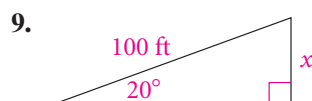
Describe each angle as it relates to the situation in the diagram.

1.  $\angle 1$     2.  $\angle 2$     3.  $\angle 3$     4.  $\angle 4$     5.  $\angle 5$     6.  $\angle 6$     7.  $\angle 7$     8.  $\angle 8$



**Example 2**  
(page 483)

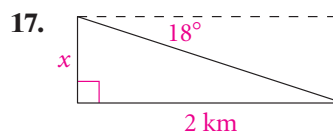
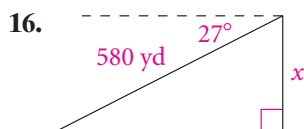
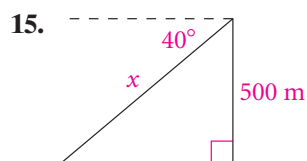
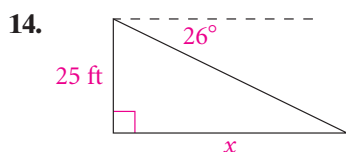
Find the value of  $x$ . Round the lengths to the nearest tenth.



13. **Meteorology** A meteorologist measures the angle of elevation of a weather balloon as  $41^\circ$ . A radio signal from the balloon indicates that it is 1503 m from his location. To the nearest meter, how high above the ground is the balloon?

**Example 3**  
(page 483)

Find the value of  $x$ . Round lengths to the nearest tenth of a unit.



18. **Indirect Measurement** Miguel looks out from the crown of the Statue of Liberty approximately 250 ft above ground. He sights a ship coming into New York harbor and measures the angle of depression as  $18^\circ$ . Find the distance from the base of the statue to the ship to the nearest foot.

### B Apply Your Skills



19. **Flagpole** The world's tallest unsupported flagpole is a 282-ft-tall steel pole in Surrey, British Columbia. The shortest shadow cast by the pole during the year is 137 ft long. To the nearest degree, what is the angle of elevation of the sun when the shortest shadow is cast?



### Reading Math

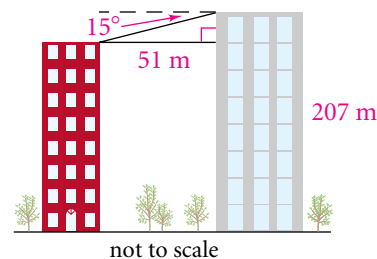
For help with Exercise 23, see Reading Math on p. 489.



- 20. Engineering** The Americans with Disabilities Act states that wheelchair ramps can have a slope no greater than  $\frac{1}{12}$ . Find the angle of elevation of a ramp with this slope. Round your answer to the nearest tenth.



- 21. Construction** Two office buildings are 51 m apart. The height of the taller building is 207 m. The angle of depression from the top of the taller building to the top of the shorter building is  $15^\circ$ . Find the height of the shorter building to the nearest meter.



- 22. a. Open-Ended** Draw and label a diagram that shows your own real-world example of an angle of elevation and an angle of depression.
- b. Writing** Write a word problem that uses the angle of depression from your diagram. Include a detailed solution to your problem.



- 23. Aerial Television** A blimp is providing aerial television views of a football game. The television camera sights the stadium at a  $7^\circ$  angle of depression. The blimp's altitude is 400 m. What is the line-of-sight distance from the TV camera to the stadium, to the nearest hundred meters?



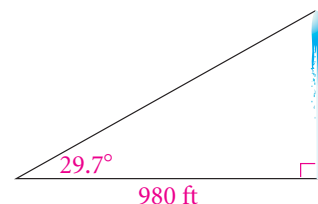
- Algebra** The angle of elevation  $e$  from  $A$  to  $B$  and the angle of depression  $d$  from  $B$  to  $A$  are shown below. Find the measure of each angle.

**24.**  $e: (7x - 5)^\circ, d: 4(x + 7)^\circ$       **25.**  $e: (3x + 1)^\circ, d: 2(x + 8)^\circ$

**26.**  $e: (x + 21)^\circ, d: 3(x + 3)^\circ$       **27.**  $e: 5(x - 2)^\circ, d: (x + 14)^\circ$



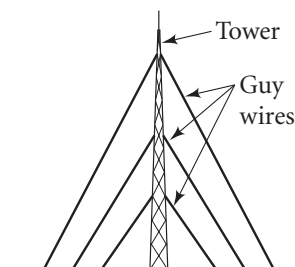
- 28. Hydromechanics** An engineer is 980 ft from the base of a fountain at Fountain Hills, Arizona. The angle of elevation to the top of the column of water is  $29.7^\circ$ . The surveyor's angle measuring device is at the same level as the base of the fountain.



- a.** Find the height of the column of water to the nearest 10 ft.
- b.** When the top of the column of water is just half as high as in part (a), find the angle of elevation to its top.



- 29. Writing** A communications tower is located on a plot of flat land. The tower is supported by several guy wires. Assume that you are able to measure distances along the ground, as well as angles formed by the guy wires and the ground. Explain how you could estimate each of the following measurements.
- a.** the length of any guy wire
- b.** how high on the tower each wire is attached




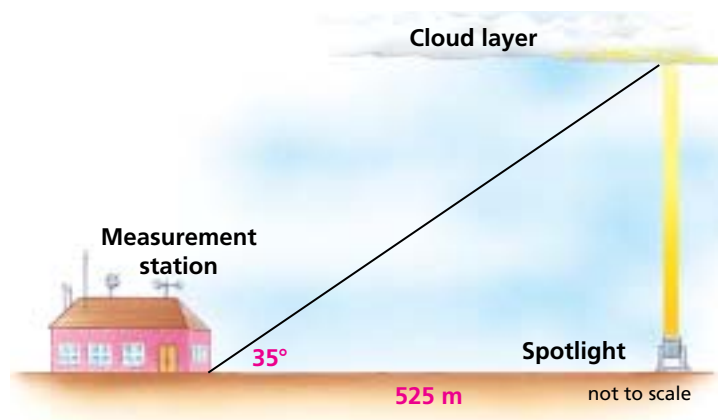
**Flying** An airplane at altitude  $a$  flies distance  $d$  towards you with velocity  $v$ . You watch for time  $t$  and measure its angles of elevation,  $\angle E_1$  and  $\angle E_2$ , at the start and end of your watch. Find the missing information.



**30.**  $a = \blacksquare$  mi,  $v = 5$  mi/min,  $t = 1$  min,  $m\angle E_1 = 45$ ,  $m\angle E_2 = 90$

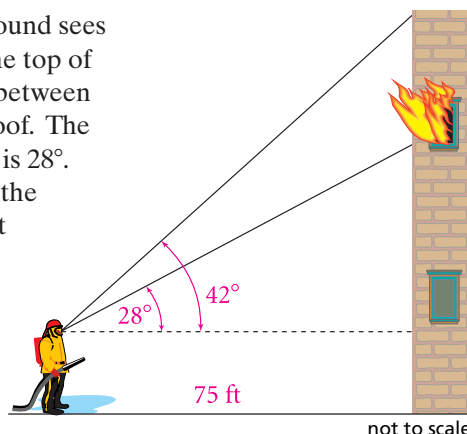
**31.**  $a = 2$  mi,  $v = \blacksquare$  mi/min,  $t = 15$  s,  $m\angle E_1 = 40$ ,  $m\angle E_2 = 50$

**32.**  $a = 4$  mi,  $d = 3$  mi,  $v = 6$  mi/min,  $t = \blacksquare$  min,  $m\angle E_1 = 50$ ,  $m\angle E_2 = \blacksquare$

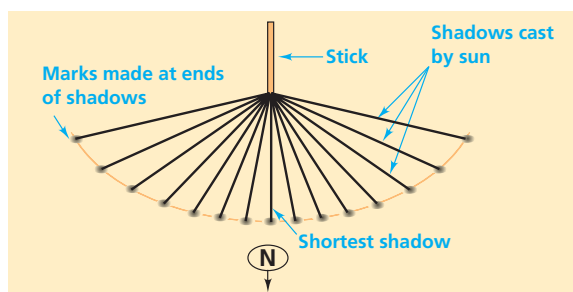
-  **33. Meteorology** One method that meteorologists could use to find the height of a layer of clouds above the ground is to shine a bright spotlight directly up onto the cloud layer and measure the angle of elevation from a known distance away. Find the height of the cloud layer in the diagram to the nearest 10 m.




-  **Challenge**  **34. Firefighting** A firefighter on the ground sees fire break through a window near the top of the building. There is voice contact between the ground and firefighters on the roof. The angle of elevation to the windowsill is  $28^\circ$ . The angle of elevation to the top of the building is  $42^\circ$ . The firefighter is 75 ft from the building and her eyes are 5 ft above the ground. What roof-to-windowsill distance can she report to the firefighters on the roof?



- 35. Indirect Measurement** Here is a simple method for finding a north-south line. Put a stick in the ground before noon and regularly mark the end of its shadow. When the shadow begins to lengthen, stop marking. The mark closest to the stick is directly north of the stick.



Explain how you could use this method to find the angle of elevation of the sun at noon (when the sun is highest in the sky).

-  **36. Geography** For locations in the United States, the relationship between the latitude  $\ell$  and the greatest angle of elevation  $a$  of the sun at noon on the first day of summer is  $a = 90^\circ - \ell + 23\frac{1}{2}^\circ$ . Find the latitude of your town. Then determine the greatest angle of elevation of the sun for your town on the first day of summer.



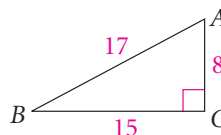
## Standardized Test Prep

### Multiple Choice

37. A 107-ft-tall building casts a shadow of 90 ft. To the nearest whole degree, what is the angle of elevation to the sun?  
 A.  $33^\circ$                       B.  $40^\circ$                       C.  $50^\circ$                       D.  $57^\circ$
38. The angle of depression of a submarine from another Navy ship is  $28^\circ$ . The submarine is 791 ft from the ship. About how deep is the submarine?  
 F. 371 ft                      G. 421 ft                      H. 563 ft                      I. 698 ft
39. A kite on a 100-ft string has an angle of elevation of  $18^\circ$ . The hand holding the string is 4 ft from the ground. How high above the ground is the kite?  
 A. 95 ft                      B. 35 ft                      C. 31 ft                      D. 22 ft

### Quantitative Comparison

- Compare the boxed quantity in Column A with the boxed quantity in Column B. Choose the best answer.
- A. The quantity in Column A is greater.  
 B. The quantity in Column B is greater.  
 C. The two quantities are equal.  
 D. The relationship cannot be determined from the information given.



Column A

Column B

40.	$\sin A$	$\cos A$
41.	$\sin A$	$\cos B$
42.	$\tan A$	$\cos B$
43.	$\frac{\sin A}{15}$	$\frac{\sin B}{8}$

### Short Response

44. A 6-ft-tall man is viewing the top of a tree with an angle of elevation of  $83^\circ$ . He is standing 12 ft from the base of the tree.
- Draw a sketch of the situation. Show a stick figure for the man. Label the angle of elevation, the height of the man, and the distance the man is standing from the tree.
  - Write and solve an equation to find the height of the tree. Round your answer to the nearest foot.



### Take It to the NET

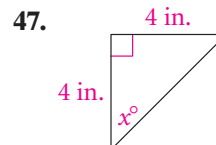
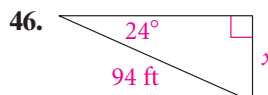
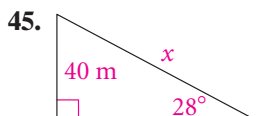
Online lesson quiz at  
[www.PHSchool.com](http://www.PHSchool.com)

Web Code: afa-0903

## Mixed Review

### Lesson 9-2

Find the value of  $x$ . Round answers to the nearest tenth.



**Lesson 7-6**

Find the measure of each arc in  $\odot C$ .  $\overline{PQ}$  is a diameter.

48.  $\widehat{AQ}$

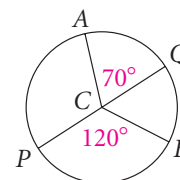
49.  $\widehat{AP}$

50.  $\widehat{BQ}$

51.  $\widehat{AOB}$

52.  $\widehat{PAB}$

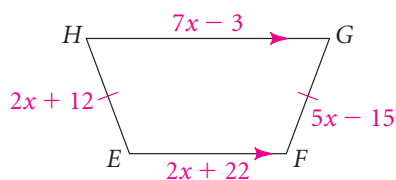
53.  $\widehat{BPA}$



**Lesson 6-1**

Find the value of each variable. Then find the length of each side.

54.



55.

